

35

Influenza A Virus HA subtypes H5, H7, and H9, Influenza A Virus NA subtypes N1, N2, N7, and N9, and Influenza A Virus NP and M1.

6. The immunogenic composition of claim 1, further comprising one or more free immunogenic proteins of Influenza Virus proteins in the excipient.

7. The immunogenic composition of claim 1, wherein the adjuvant includes a Toll-Like Receptor (TLR) agonist selected from the group consisting of is TLR5 agonist, a TLR7 agonist, or a TLR9 agonist;

a liposome, a mineral salt, an oil emulsion, a polymer, a polysaccharide, a saponin, CpG oligonucleotide, or a STING activating adjuvant.

8. The immunogenic composition of claim 1 further comprising a second adjuvant in the excipient.

9. An immunogenic composition comprising:

one or more polyanhydride copolymers forming a biodegradable first polyanhydride nanoparticle, the copolymers including 1,8-bis(p-carboxyphenoxy)-3,6-dioxaoctane (CPTEG) and 1,6-bis(p-carboxyphenoxy) hexane (CPH) in a ratio of about 20:80;

an adjuvant;

one or more immunogenic proteins of an Influenza Virus, the Influenza Virus selected from the group consisting of Influenza A Virus, Influenza B Virus, Influenza C Virus, and Influenza D Virus wherein each of the adjuvant and the one or more immunogenic proteins are entrapped within the nanoparticle;

a targeting protein comprising an antibody or ligand disposed on at least a portion of a surface of the nanoparticle that targets the nanoparticle to a lung dendritic cell or a lung macrophage cell; and an excipient.

10. The immunogenic composition of claim 9, wherein the antibody or the ligand disposed on the surface of the nanoparticle specifically binds to CLEC9a, Dectin-1, SIRpa, or MERTK.

11. An immunogenic composition comprising:

one or more polyanhydride copolymers forming a biodegradable first polyanhydride nanoparticle, the copolymers including 1,8-bis(p-carboxyphenoxy)-3,6-dioxaoctane (CPTEG) and 1,6-bis(p-carboxyphenoxy) hexane (CPH) in a ratio of about 20:80;

an adjuvant;

one or more immunogenic proteins of an Influenza Virus, the Influenza Virus selected from the group consisting of Influenza A Virus, Influenza B Virus, Influenza C

36

Virus, and Influenza D Virus wherein each of the adjuvant and the one or more immunogenic proteins are entrapped within the nanoparticle; and

an excipient; wherein the nanoparticles comprise by weight about 1% HA protein, about 1% NP protein, and about 2% CpG oligonucleotide.

12. A method of inducing an immune response to influenza in a subject comprising administering to the subject an effective amount of the immunogenic composition of claim 1 to induce the immune response.

13. The method of claim 12 further comprising administering to the subject at least a second biodegradable polyanhydride nanoparticle formed of one or more polyanhydride copolymers, the copolymers including CPTEG and CPH in a ratio of about 20:80; a second immunogenic protein of an Influenza Virus and an adjuvant within an interior of the second nanoparticle, the second immunogenic protein being different than the immunogenic protein.

14. The method of claim 12, wherein the immunogenic proteins comprise one or more subtypes of the Influenza A virus selected from the group consisting of H1, H2, H3, H5, and H7.

15. The method of claim 12, wherein the adjuvant comprises a Toll-Like Receptor (TLR) agonist selected from the group consisting of is TLR5 agonist, a TLR7 agonist, or a TLR9 agonist;

a liposome, a mineral salt, an oil emulsion, a polymer, a polysaccharide, a saponin, CpG oligonucleotide, or a STING activating adjuvant.

16. The method of claim 12, wherein the nanoparticle further comprises a targeting protein disposed on at least a portion of a surface of the nanoparticle that targets the nanoparticle to a specific cell type.

17. The method of claim 12, wherein the nanoparticles comprise by weight about 2.5% HA, about 2.5% NP, and about 2% CpG oligonucleotide.

18. The method of claim 17, wherein the nanoparticles comprise by weight about 1% HA, about 1% NP, and about 2% CpG oligonucleotide.

19. The method of claim 12, wherein the administering comprises intranasal administration and an optional subsequent intramuscular or subcutaneous administration.

20. The method of claim 12, wherein the immune response comprises both a local immune response and a systemic immune response.

* * * * *